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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/675,072	09/30/2003	Yumin Tao	1288R	5528

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EXAMINER	
COLLINS, CYNTHIA E	

ART UNIT	PAPER NUMBER
1638	

DATE MAILED: 04/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/675,072	TAO ET AL.	
	Examiner	Art Unit	
	Cynthia Collins	1638	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 February 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-47* is/are pending in the application.

4a) Of the above claim(s) *1-22 and 24-47* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *9/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group XIII, Claim 23, in the reply filed on February 9, 2006 is acknowledged. Claims 1-22 and 24-47 are withdrawn from consideration.

Claim Objections

Claim 23 is objected to because of the following informalities: claim 23 is directed in part to a nonelected invention (introduction into a plant cell of at least one CHD polypeptide). Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 23 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The claim is drawn to a method for inducing apomixis in a plant cell comprising introducing into a responsive plant cell at least one CHD polynucleotide to produce a

transformed plant cell and growing the transformed plant cell under conditions sufficient to produce a transformed somatic embryo.

The specification at page 5 defines a "CHD polynucleotide" as "a nucleic acid sequence encoding a CHD polypeptide. As used herein, "CHD polypeptide" means a polypeptide containing 3 domains, a chromatin organization modifier, a helicase SNF-2 related/ATP domain, and a DNA binding domain. CHD is an acronym based on the first letter of the names of the 3 domains." The specification at page 6 also defines a "responsive cell" as "a cell that exhibits a positive response to the introduction of CHD polypeptide or CHD polynucleotide compared to a cell that has not been introduced with CHD polypeptide or CHD polynucleotide. The response can be to enhance tissue culture response, induce somatic embryogenesis, induce apomixis, increase transformation efficiency or increase recovery of regenerated plants.". The specification additionally discloses the isolation from maize of est cDNAs that encode polypeptides having amino acid sequence homology to CHD chromatin remodeling enzymes (pages 35-38). The specification further suggests that CHD expression be downregulated in the inner integument or nucellus to induce apomixis through the use of a nucellus specific CHD-DR expression cassette. The specification at page 39 defines a CHD-DR construct as "an expression cassette in which the transcribed RNA results in decreased levels of CHD protein in the cell. Examples would include expressing antisense, expressing an inverted-repeat sequence (which will form a hairpin) constructed from a portion of the CHD sequence, expressing the CHD sequence fused to another such "hairpin" forming sequence, or expressing CHD in a manner that will favor co-suppression of endogenous CHD." The specification does not describe the specific structural attributes of any "CHD

polynucleotide" that functions to induce apomixis upon introduction into a plant cell. The specification also does not describe the specific structural attributes of any cell in which apomixis is induced upon the introduction of a CHD polynucleotide.

The Federal Circuit has recently clarified the application of the written description requirement. The court stated that "A description of a genus of cDNAs may be achieved by means of recitation of a representative number of cDNAs, defined by nucleotide sequence, falling within the scope of the genus or of a recitation of structural features common to members of the genus, which features constitute a substantial portion of the genus." See *University of California v. Eli Lilly and Co.*, 119 F.3d 1559, 1569; 43 USPQ2d 1398, 1406 (Fed. Cir. 1997).

In the instant case Applicant has not described a representative number of species falling within the scope of the claimed genus which encompasses CHD polynucleotides that function to induce apomixis upon introduction into a plant cell, nor the structural features unique to the genus. Applicant also has not described a representative number of species falling within the scope of the claimed genus which encompasses cells in which apomixis is induced upon the introduction of a CHD polynucleotide, nor the structural features unique to the genus.

Claim 23 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The claim is drawn to a method for inducing apomixis in a plant cell comprising introducing into a responsive plant cell at least one CHD polynucleotide to produce a transformed plant cell and growing the transformed plant cell under conditions sufficient to produce a transformed somatic embryo.

The specification at page 5 defines a "CHD polynucleotide" as "a nucleic acid sequence encoding a CHD polypeptide. As used herein, "CHD polypeptide" means a polypeptide containing 3 domains, a chromatin organization modifier, a helicase SNF-2 related/ATP domain, and a DNA binding domain. CHD is an acronym based on the first letter of the names of the 3 domains." The specification at page 6 also defines a "responsive cell" as "a cell that exhibits a positive response to the introduction of CHD polypeptide or CHD polynucleotide compared to a cell that has not been introduced with CHD polypeptide or CHD polynucleotide. The response can be to enhance tissue culture response, induce somatic embryogenesis, induce apomixis, increase transformation efficiency or increase recovery of regenerated plants.". The specification additionally discloses the isolation from maize of est cDNAs that encode polypeptides having amino acid sequence homology to CHD chromatin remodeling enzymes (pages 35-38). The specification further suggests that CHD expression be downregulated in the inner integument or nucellus to induce apomixis through the use of a nucellus specific CHD-DR expression cassette (page 43). The specification at page 39 defines a CHD-DR construct as "an expression cassette in which the transcribed RNA results in decreased levels of CHD protein in the cell. Examples would include expressing antisense, expressing an inverted-repeat sequence (which will form a hairpin) constructed from a portion of the CHD sequence, expressing the CHD sequence fused to another such

"hairpin" forming sequence, or expressing CHD in a manner that will favor co-suppression of endogenous CHD." The specification does not disclose how to make and use any particular "CHD polynucleotide" that functions to induce apomixis upon introduction into a plant cell, or any particular cell in which apomixis is induced upon the introduction of a CHD polynucleotide.

The claimed invention is not enabled because the downregulation of the expression of a particular gene in plants is unpredictable, as the ability of a construct to suppress gene expression depends on multiple variables which include but are not limited to the type of components used and their arrangement within the construct, the degree of homology between the construct components and the gene to be downregulated, the presence or absence of other homologous genes in the genome of the target cell, and the level at which the expression of the gene is regulated.

See, for example, Sandler S.J. et al. (Inhibition of gene expression in transformed plants by antisense RNA. Plant Molecular Biology, 1988, Vol. 11, No. 3, pages 301-310), who teach that DNA fragments encoding different portions of the nopaline synthase gene, when expressed as antisense transcripts, vary in their ability to inhibit nopaline synthase gene expression (page 308 column 2 and Table 4, page 309 column 1 first full paragraph). Antisense transcripts downstream from the Cla I site (nucleotide 373) effectively suppressed nopaline synthase gene expression, whereas the full length antisense transcript and the antisense transcript upstream from the Cla I site (nucleotides 1 to 373) did not (id).

See also, for example, van der Krol A.R. et al. (Inhibition of flower pigmentation by antisense CHS genes: promoter and minimal sequence requirements for the antisense

effect. Plant Mol Biol. 1990 Apr;14(4):457-66), who teach a method of decreasing the expression of an endogenous petunia chalcone synthase gene by transforming petunia cells with chimeric genes comprising chalcone synthase (CHS) coding sequences operably linked in an antisense orientation to a CaMV 35S constitutive promoter. The full length CHS cDNA and CHS sequences encoding half-length or quarter-length RNA complementary to the 3' half of the CHS mRNA decreased the expression of endogenous CHS, whereas half-length RNA complementary to the 5' half of the CHS mRNA did not (page 460 Figures 1 and 2;page 461 Figure 3).

See additionally, for example, Waterhouse et al. (Virus resistance and gene silencing: killing the messenger. Trends Plant Sci. 1999 Nov;4(11):452-457), who teach that antisense suppression of gene expression requires a high degree of sequence homology (>75%) between the endogenous sequence and the antisense transgene to be effective (page 453 column 1 second full paragraph).

See further, for example, Temple S.J. et al. (Down-regulation of specific members of the glutamine synthetase gene family in alfalfa by antisense RNA technology. Plant Mol Biol. 1998 Jun;37(3):535-47), who introduced into alfalfa antisense gene constructs aimed specifically at two distinct classes of Glutamine synthetase 1 genes. While the gene constructs were effective in lowering the corresponding transcript levels, transgenic alfalfa with up to 80% reduction in the transcript level corresponding to the two genes showed no reduction in Glutamine synthetase activity, or in Glutamine synthetase 1 polypeptide level, suggesting that Glutamine synthetase 1 mRNA levels are not rate-limiting for Glutamine synthetase 1 polypeptide synthesis, and that Glutamine synthetase

1 levels are controlled both at the transcriptional and translational/post-translational level. (abstract ; Figures 3, 5 and 6 ; page 541 column 2 and pages 543-545).

In the instant case the specification does not provide sufficient guidance with respect to the type of components to use in a CHD-DR construct or their arrangement within the construct, or the requisite degree of homology between the construct components and the CHD gene to be downregulated, or the presence or absence of other homologous CHD genes in the genome of the target cell, or the level at which CHD gene expression is regulated, or other relevant variables, such that a CHD-DR construct will have the desired functional effect (induce apomixis in a plant cell). Absent such guidance one skilled in the art would have to construct a myriad of CHD-DR constructs comprising different components in different arrangements, and test each construct in a variety of different types of plant cells for its ability to induce apomixis in order to identify a particular construct that functions as claimed. Such a trial and error approach to practicing the claimed invention would constitute undue experimentation.

The claimed invention is also not enabled because apomixis cannot predictably be induced in a plant cell by the downregulation of CHD gene expression, because CHD gene products differ with respect to their function and role in cellular processes, and because CHD gene products whose reduction induces apomixis in plant cells are not known or disclosed.

See, for example, Eissenberg J.C. (Molecular biology of the chromo domain: an ancient chromatin module comes of age. Gene. 2001 Sep 5;275(1):19-29. Review), who teaches that chromo domains have been found in single or multiple copies in proteins with diverse structures and activities (abstract). Eissenberg J.C. teaches that since the

term chromo domain was first coined the number of identified chromo domain proteins has grown, both in terms of chromo domain proteins that are homologs of the *Drosophila* proteins HP1 and Polycomb, and in terms of the diversity of otherwise unrelated chromo domain proteins that contain one or more of the domains characteristic of this class of proteins (page 19 column 2). Eissenberg J.C. also teaches that while some chromo domain-containing protein families appear to be associated with gene silencing, other chromo domain-containing protein families appear to be involved in gene activation, and the *Drosophila* protein HP1 has been found to mediate both gene silencing and gene activation in different chromosomal contexts (page 19 column 2; page 27 column 1).

In the instant case the specification does not provide sufficient guidance with respect to which CHD gene to downregulate in a plant cell such that apomixis is induced. Absent such guidance one skilled in the art would have to target a myriad of plant CHD genes for downregulation and evaluate the effect of downregulating each on the induction of apomixis in order to determine which plant CHD genes to downregulate. Such a trial and error approach to practicing the claimed invention would constitute undue experimentation.

Remarks

No claim is allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cynthia Collins whose telephone number is (571) 272-0794. The examiner can normally be reached on Monday-Friday 8:45 AM -5:15 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anne Marie Grunberg can be reached on (571) 272-0975. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Cynthia Collins
Primary Examiner
Art Unit 1638

CC

Cynthia Collins
4/4/06